COORDINATION AND DATA MANAGEMENT OF THE INTERNATIONAL ARCTIC BUOY PROGRAM

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LONG TERM GOALS

To maintain a research quality database of direct measurements and analyzed fields of surface air temperature, sea level pressure, ice motion and other geophysical quantities in the Arctic Basin using drifting buoys.

OBJECTIVES

To coordinate resources to maintain a network of drifting buoys in the Arctic Basin that measure pressure, temperature and other geophysical quantities. To maintain a research quality database of these observations.

To study possible improvements in the analyzed geophysical fields. The data collected meet meteorological, climatological, and oceanographic requirements for both research and operational needs. Figure 1 shows the positions of buoys from 1979 through the present. Figure 2 shows the mean annual field of ice motion and sea level pressure.

APPROACH

Coordination of the IABP falls into the categories of information, resource management, and meeting planning. Information is primarily distributed via a monthly buoy position charts and by one-to-one correspondence. More general information is available in a published brochure. Resource management is focused on matching buoy hardware and deployment opportunities to the requirements of maintaining the buoy network.

Data management consists of analyzing the available buoy data and producing data sets of ice motion, sea level pressure, and air temperature for research use. These data sets are described in annual reports, and are archived at the World Data Center, but primary distribution of the data sets has been through the Polar Science Center (PSC) via anonymous ftp. These data and other research products of the IABP are now also available on the World Wide Web.

Our recent efforts to improve the database have been directed towards producing a new surface air temperature (SAT) analysis which combines data from the buoys with data from land stations using the objective analysis procedure, optimal interpolation. This analysis builds on the SAT work of Martin and Munoz, 1997, by utilizing new spatial and seasonal statistics in the interpolation scheme.

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ACCOMPLISHMENTS

Our res   earch on the surface air temperature (SAT) data has been presented at the annual meeting of the International Arctic Buoy Program in St. Petersburg, Russia, and will also be presented at the World Climate Research Programme's Conference on Polar Processes and Global Climate, in Orcas Island, WA. The SAT fields have been analyzed at a 12-hourly interval, from 1979 through 1996, and are available from our FTP/HTTP servers on the internet.

Annual reports on the buoy data have been published for 1995 and 1996. Digital copies of these reports are also available from our FTP/HTTP servers.

SCIENTIFIC/TECHNICAL RESULTS

Spatial and seasonal statistical analysis of the SAT observations from the buoys and land stations show very different characteristics, especially during the summer months (Figure 3.). These statistics are important for the proper optimal interpolation of SAT fields. The SAT over the ocean during summer is controlled by the melting temperature of sea ice, coastal SAT are similarly constrained. Cross correlations between the different observations yield different correlation length scales between the observations during different seasons. Most significantly, very little correlation was found between the land station observations and the ocean observations during the summer months.

IMPACT FOR SCIENCE

The buoy data meet meteorological, climatological and oceanographic requirements for both research and perational components internationally, and thus the buoy program has gained widespread support. High latitude countries use the data to forecast weather. The data are essential in monitoring climate, assessing the environment, validating model simulations of atmospheric temperature and pressure and ice drift. Specifically, operational weather prediction programs in the circumpolar countries benefit from the surface pressure and temperature data that the network provides. The archived data have been used to study ice motion and dynamics in the Basin. The pressure data are used to estimate the mean surface wind, which can drive sea ice models, and for input into climate change studies.

Recent research using the IABP databases includes back and forward trajectory analysis to study the origins and fate of samples taken from the sea ice. Given the current location of a piece of ice, using the IABP databases, we can trace its probable history, and predict its future deposition. Results of these studies have been published or presented in collaboration with various colleagues.

TRANSITIONS

Lessons that we have learned from the spatial and seasonal analysis of SAT statistics can be applied to the observations of sea ice motion by the buoys to produce an improved analyzed field of ice motion.

RELATED PROJECTS

None.

PUBLICATIONS

Rigor, I. and R. Colony, Sea Ice Production in the Laptev Sea, Sci.Total Environ., v. 202, p. 89-110, 1997.

Pfirman, S.L, J.W. Kögeler, and **I. Rigor**, in press: Potential Shortcuts for Transport of Contaminants from the Kara Sea, Sci.Total Environ., v. 202, p. 111-122, 1997.

Pfirman, S.L., R. Colony, D. Nürnberg, H. Eicken, and **I. Rigor**, Reconstructing the Origin and Trajectory of Drifting Arctic Sea Ice, J. Geophy. Res., v. 102 n.6 p. 12575- , 1997.

Landa, E., E. Reimnitz, D. Beals, J. Pochkowski, and **I. Rigor**, Transport of 137 Cs and 239,240 Pu by Ice Rafted Debris in the Arctic Ocean, Arctic, accepted.

Rigor, I., and A. Heiberg, 1997: International arctic buoy program data report, 1 January 1996 - 31 December 1996, APL-UW TM 05-97, Applied Physics Laboratory, University of Washington, May 1997.

Rigor, I., and A. Heiberg, 1997: International arctic buoy program data report, 1 January 1995 - 31 December 1995, APL-UW TM 04-97, Applied Physics Laboratory, University of Washington, May 1997.

Rigor, I., R. Colony and E. A. Muñoz, Statistics of Surface Air Temperature Observations in the Arctic Basin, November, 1997, Proc. World Climate Research Program (WCRP) Conference on Polar Processes and Global Climate, Orcas Island, WA, November, 1997.

Warren, S.G., **I. Rigor**, N. Untersteiner, V. F. Radionov, N. N. Briazgin, Y. I. Aleksandrov, and R. Colony, Snow Cover on Arctic Sea Ice, Proc. IAMAS Symposium IP16, "Interfacial processes in ice-covered ocean," Melbourne, Australia, July 1997.

Pfirman, S., D. Gregor, **I. Rigor**, and R. M. Koerner, Role of Sea Ice in Contaminant Fate, Proc. AMAP International Symposium on Environmental Pollution of the Arctic, Tromso, Norway, June 1997

Rigor, I. and R. Colony, Sea Ice Production and Transport of Pollutants from the Russian Marginal Seas, Proc. American Geophysical Union 1996 Fall Meeting, San Francisco, CA, December, 1996.

Reimnitz. E, D.A. Meese, A. J. Gow, S.L. Pfirman, and **I. Rigor**, Ice-Borne Sediments From the Russian Shelves, Proc. American Geophysical Union 1996 Fall Meeting, San Francisco, CA, December, 1996.

Landa, E., E. Reimnitz, D. Beals, J. Pochkowski, W. Winn, and **I. Rigor**, Transport of Cs-137 and Pu-239, 240 with Ice Rafted Debris in the Arctic Ocean, Proc. American Geophysical Union 1996 Fall Meeting, San Francisco, CA, December 1996.
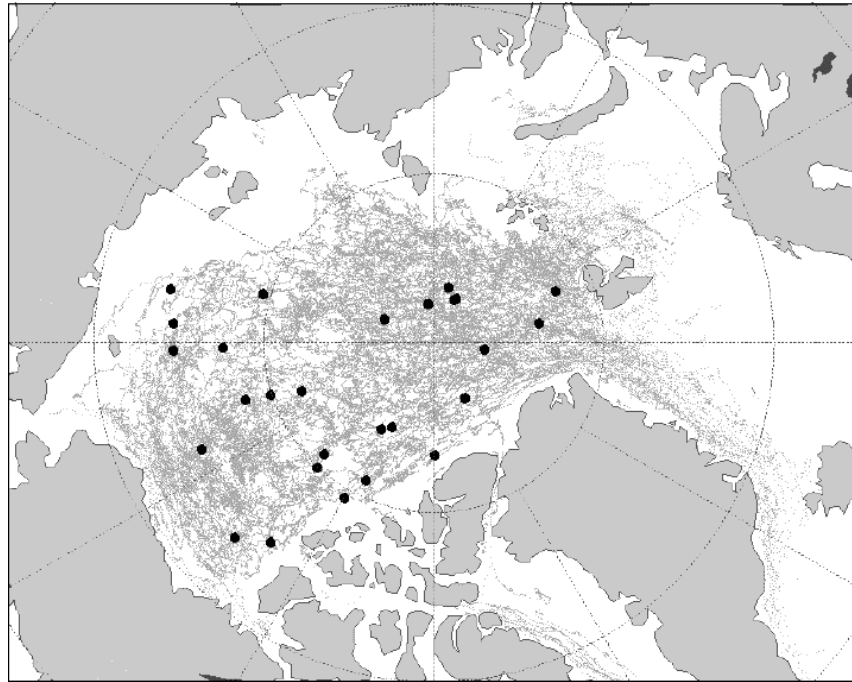
Figure 1. This map shows the daily positions of buoys reporting from 1979-1996 as small, gray dots. The black dots show the positions of buoys reporting as of October, 1997.
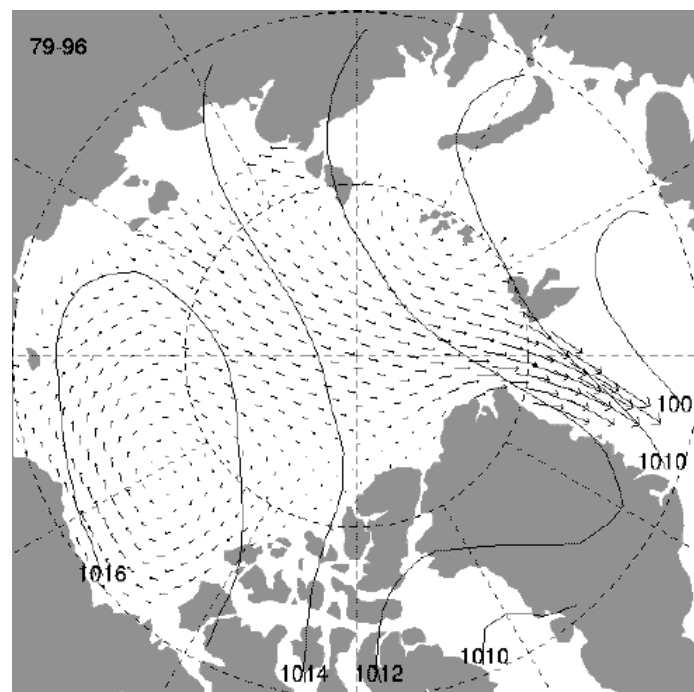

Figure 2. The map shows the annual mean fields of sea level pressure and ice motion from 1979-1996.
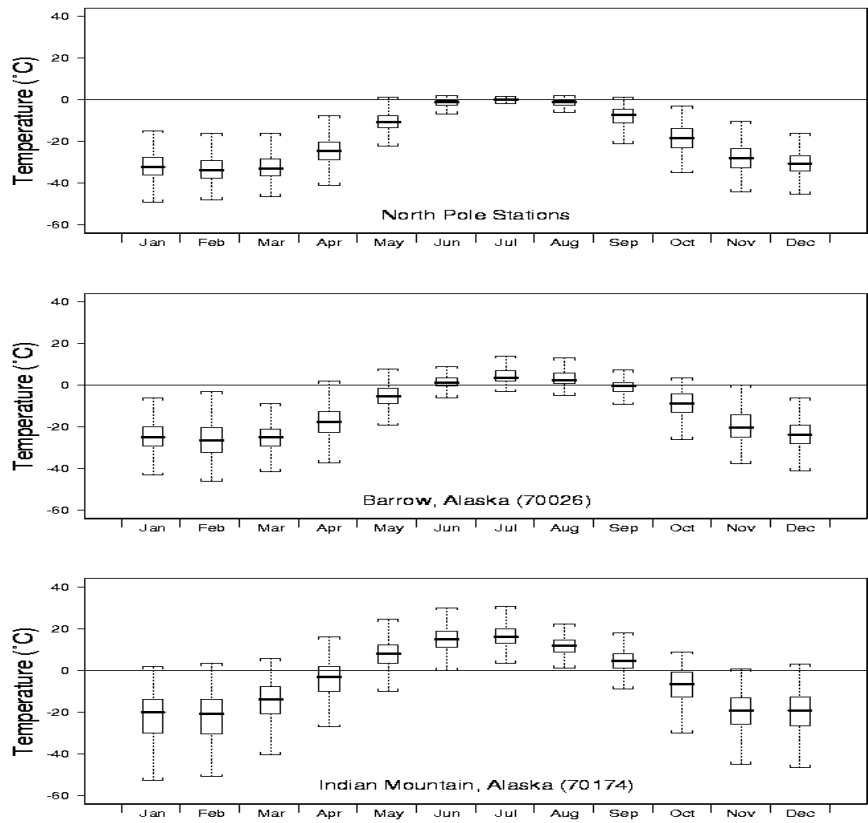
Figure 3. Monthly box plots of the observed air temperature data from all the North Pole stations from 1979-1991 (a), from the meteorological land station at Barrow (b), and at Indian Mountain (c), from 1979-1996. Each box plot shows the median, 25th, and 75th percentile. Thus half the data fall inside this box, 99% of the data fall within the range shown by the vertical lines. These distributions are based on 12-hourly observations.
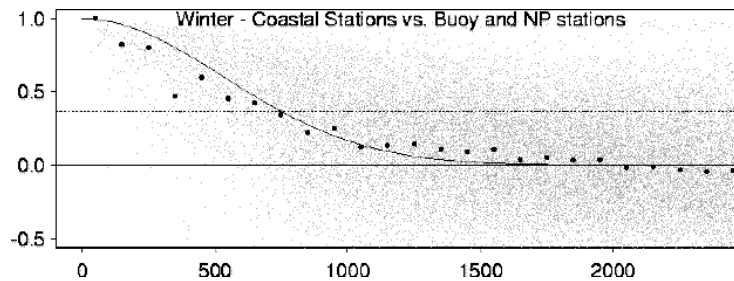

Figure 4. This figure shows the correlations of different pairs of coastal land stations with buoys or manned stations during winter from 1979-1996. Each small gray dot represents the correlation between the observations at one coastal land station with the observations at a buoy or manned station on the ice of the Arctic Ocean. The large dots are averages of 100km bins. The curved line is the plot of $\exp(d^2/L^2)$, where d is the distance between data points, and L=800 km. The large dots approximate the correct length scale of the data. These values drop below $1/\exp(1)$, the dashed line, at about 800 km.